Mine neutralization with small caliber projectile impact

TNO | Knowledge for business

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Introduction

- Method will not demand close approach of the mine
- Possible mine responses due to impact
  - Mechanical break-up or disintegration
  - Burning
  - Deflagration
  - Detonation
- Humanitarian demining requires low order reaction
- Military demining a detonation can be preferred

Experiment set-up (1)

AP 22C1 Mine

- Mass explosives
  - Main charge: 84 g
  - Detonator: 3 g

Experiment set-up (2)

.338” (8.6 mm) ← **Projectiles** → .50” (12.7 mm)

Ball

AP

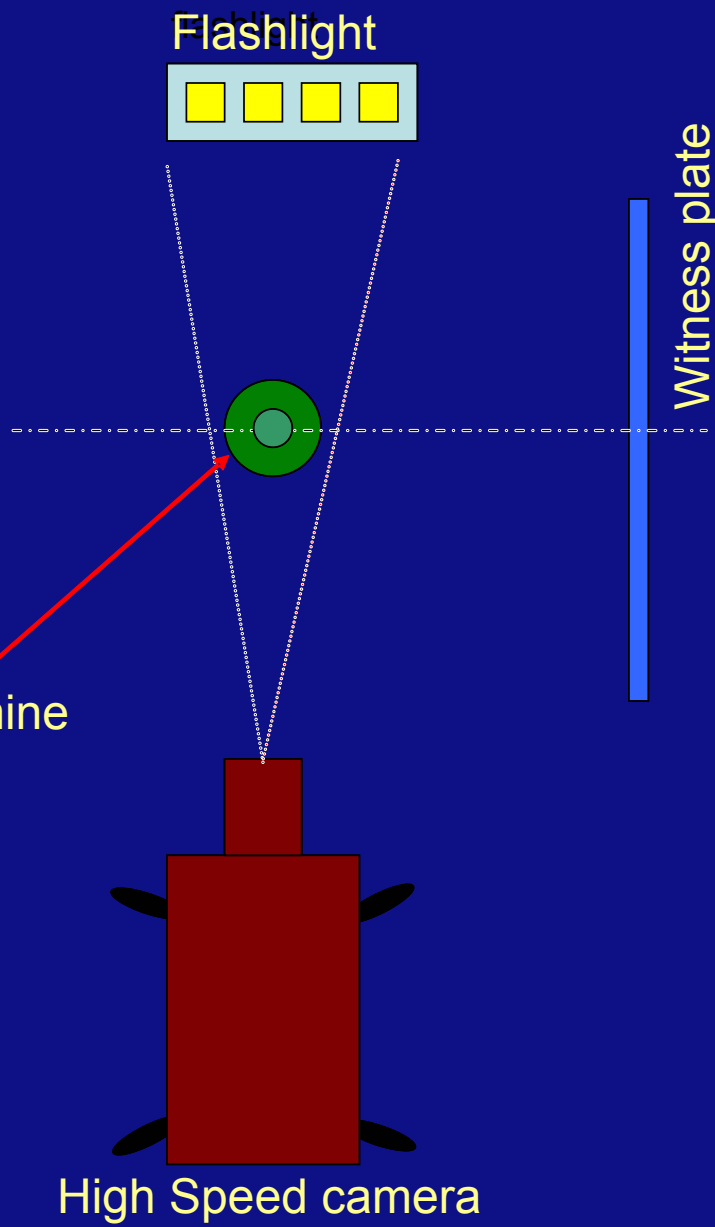
Ball

AP(I HC)

Experiment set-up (3)

Weapon

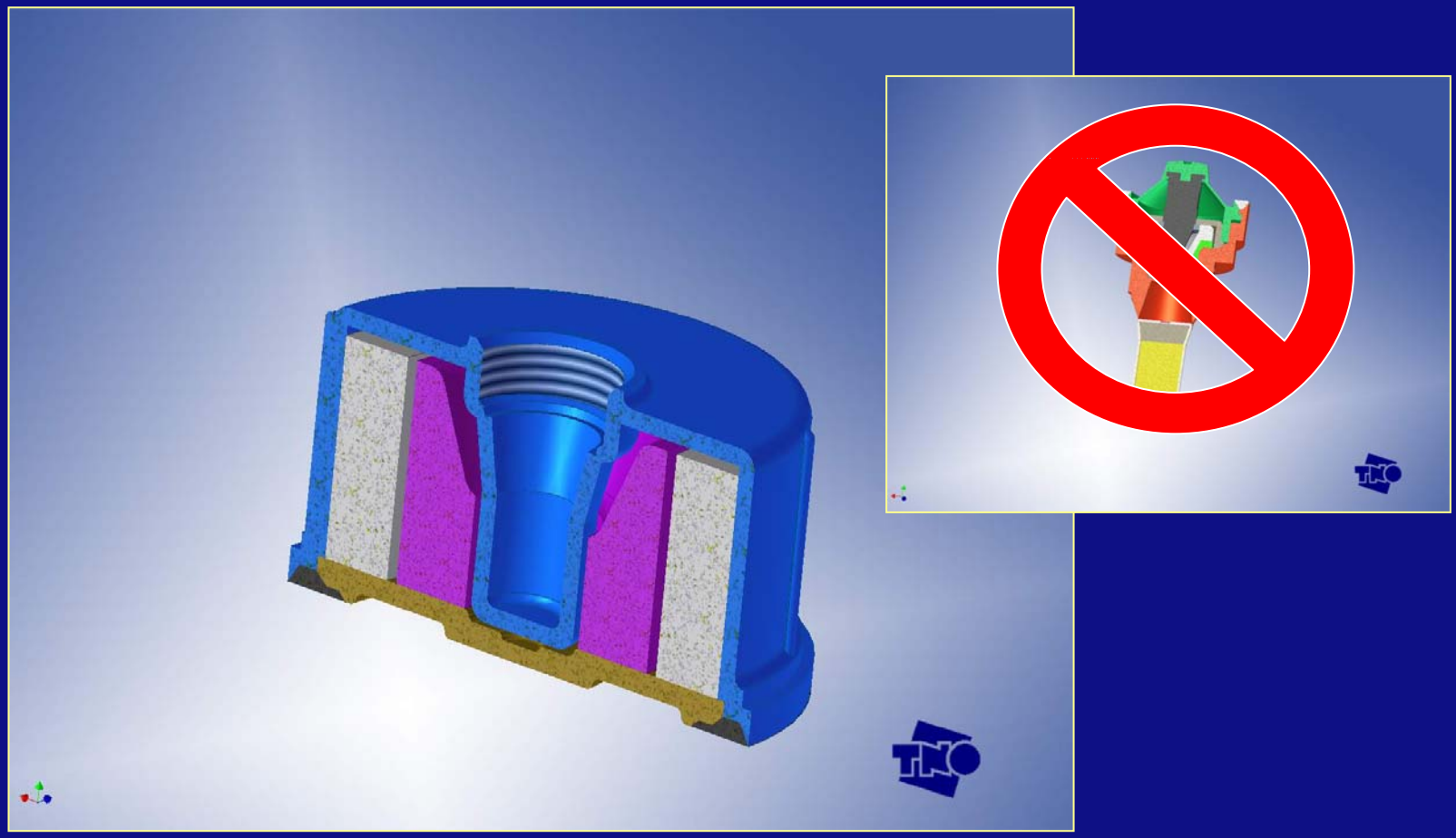
Projectile



Registration of events by use of
- High speed camera
- Normal speed video camera (25 fps)
- Witness plate

Experiment set-up (4)

RESULTS (1)
Unarmed AP 22C1 Mine (NO detonator)

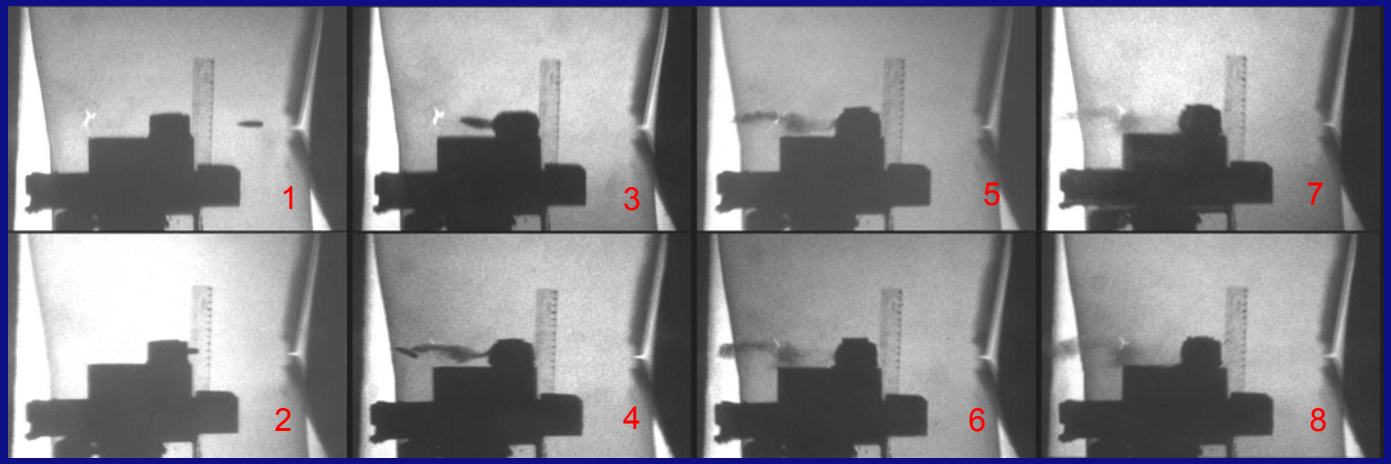


Some illustrating pictures (1)

mine remnants after impact .338 Ball

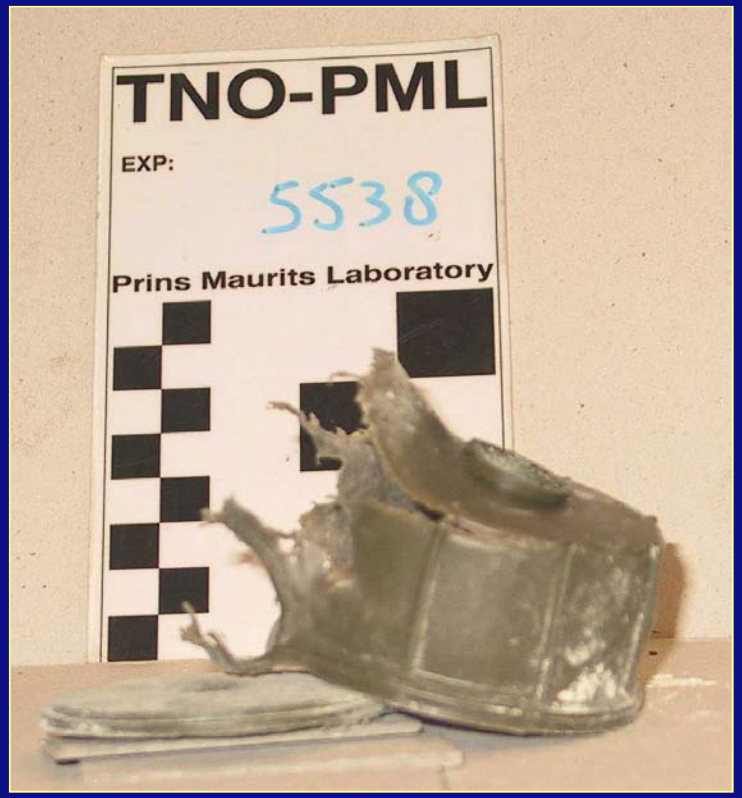
Impact hole

Exit hole



Some illustrating pictures (2)

mine remnants after impact .338” AP and .50” ball



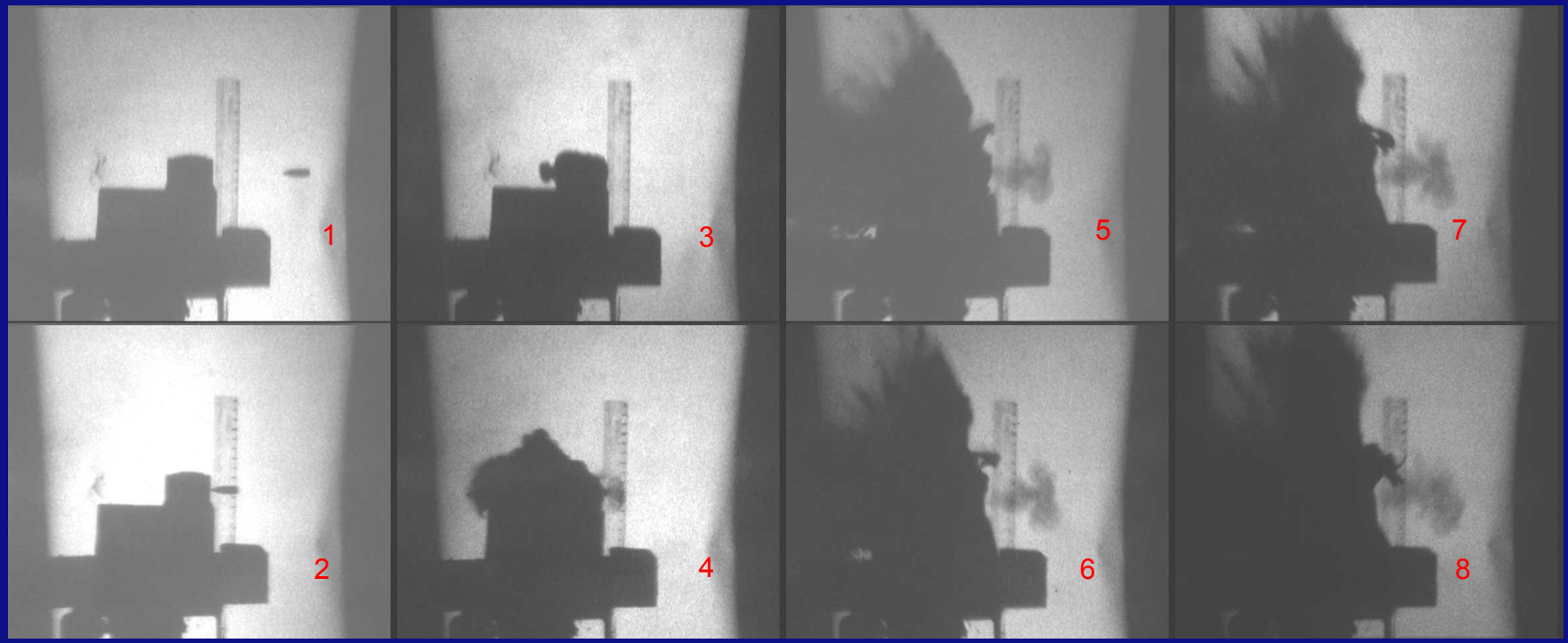
.338” AP

.50” Ball

Some illustrating pictures (3)

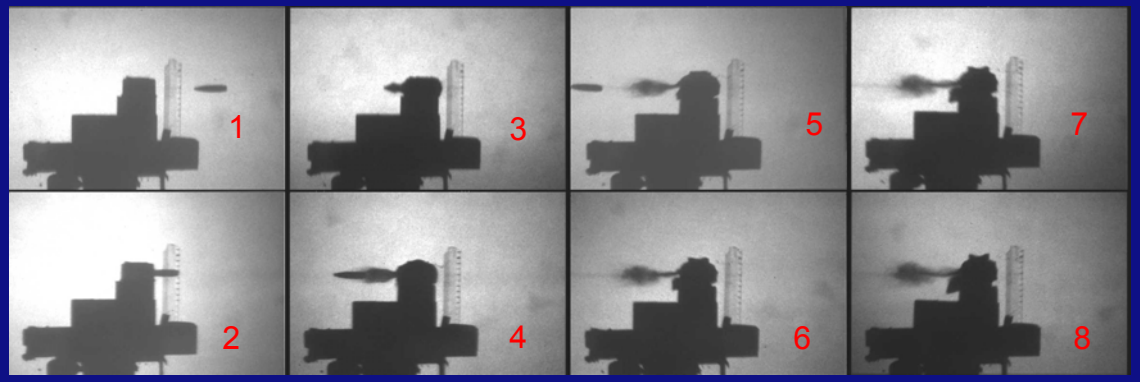
mine response on impact .338” AP and .50” ball

Typical result of .338” AP and .50” Ball
Mechanical break-up



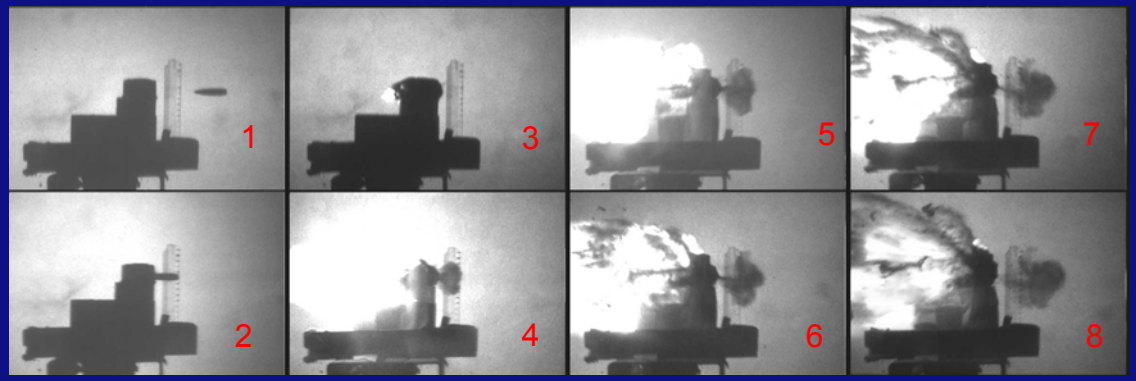
Some illustrating pictures (4)

mine response after impact .50 AP I HC



3 shots mechanical break-up only

.50” AP I HC



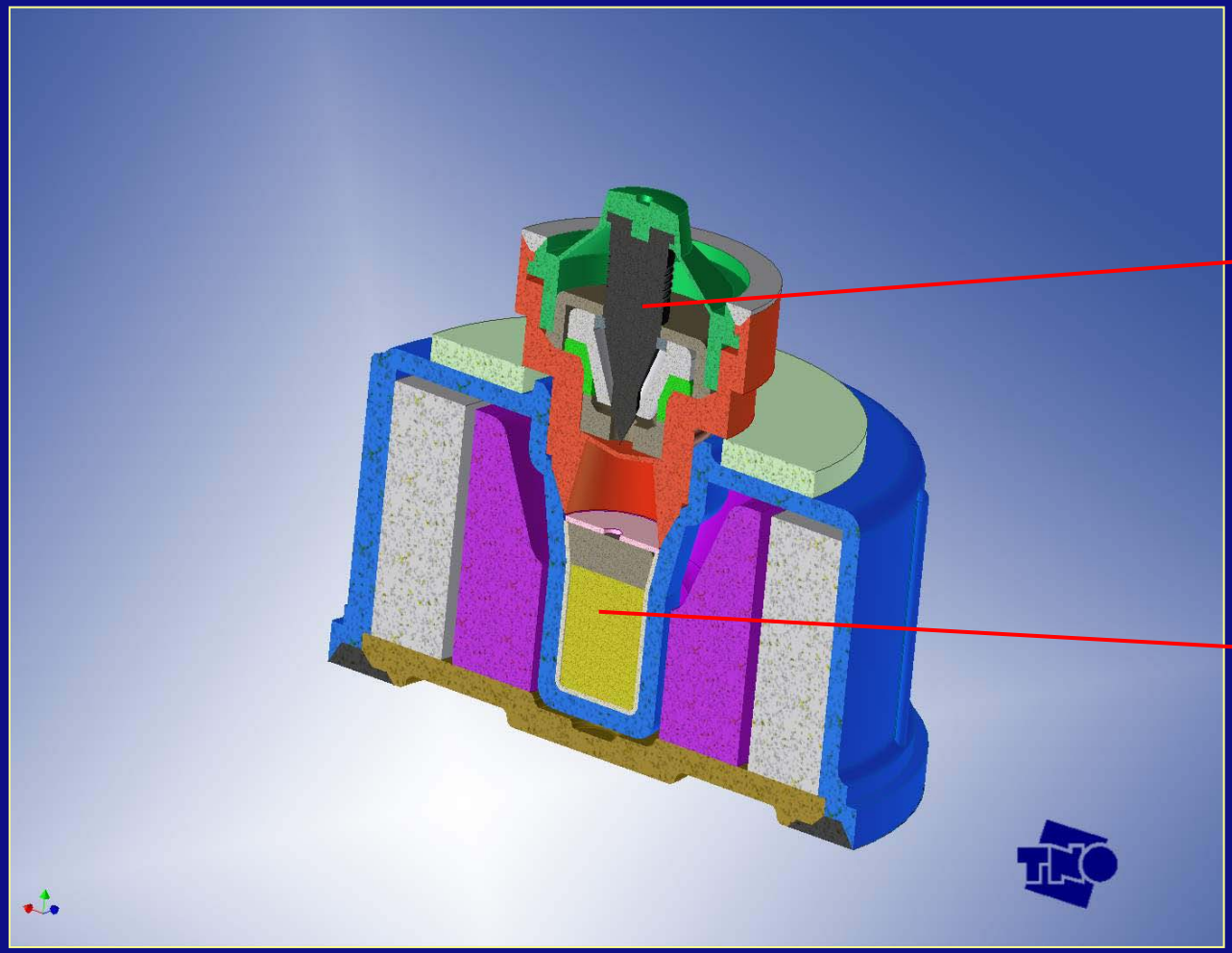
3 shots mechanical break-up and reaction of incendiary tip **(No deflagration!)**

Conclusions

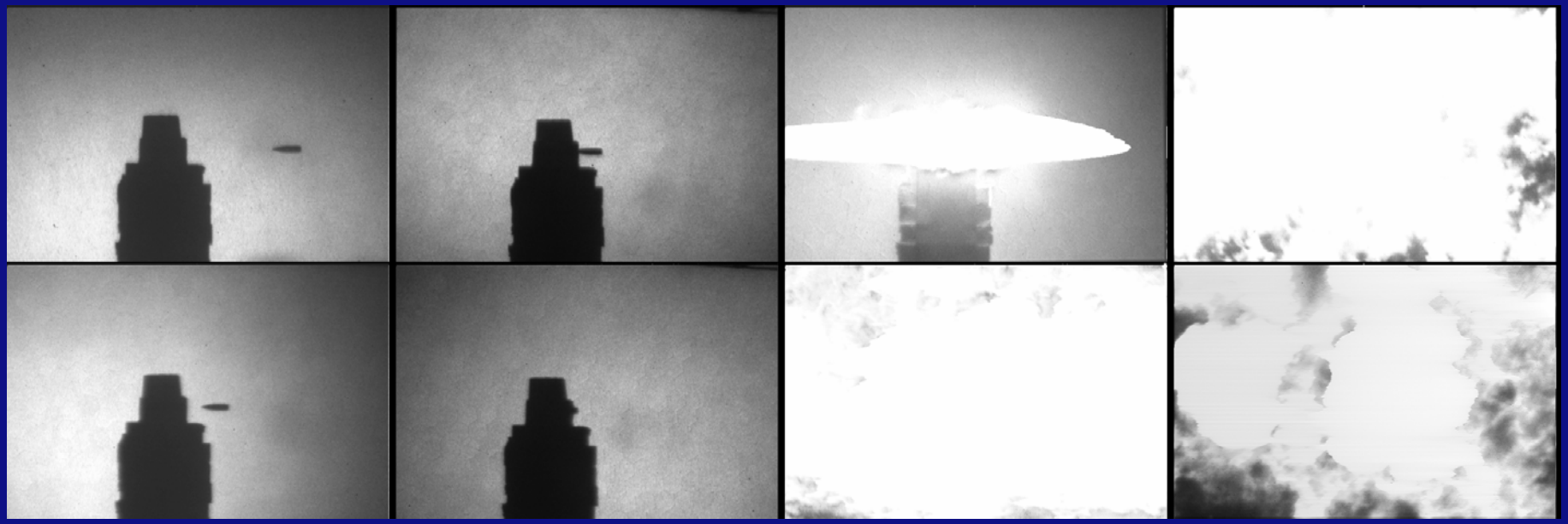
AP 22C1 mine without detonator (fuse)

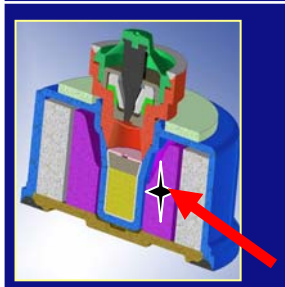
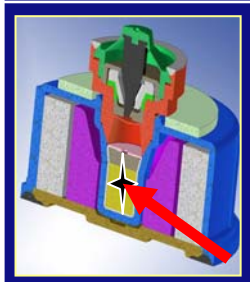
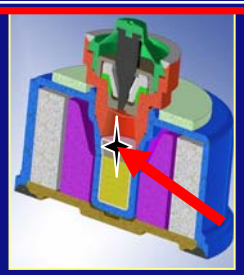
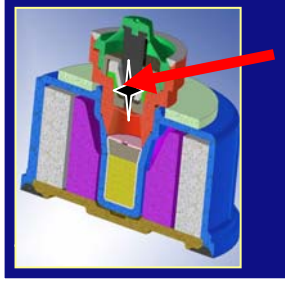
- No detonation or deflagration recorded
- .338” Ball unsuitable to neutralize mine
- All other munitions tear open mine body and pulverize explosive material
- I-tip melts TNT, no evidence of burned TNT found
- Impossible to draw conclusions on response of mine with detonator

RESULTS (2)
Armed AP 22C1 Mine (with detonator)



Illustrating picture of a detonation



Aiming point	.338 Ball	.338 AP	.50 Ball	.50 AP I HC
	**No reaction 2x**	**No reaction 1x** **Partly burned 1x**	**No experiment**	**No reaction 1x** **I-tip reacts 1x**
	**No reaction 1x**	**Partly burned 1x**	**Detonation residual explosives 1x**	**No reaction** **I-tip reacts 1x**
	**Detonation 1x** **No reaction 1x (graze)**	**Detonation 2x**	**Detonation 2x** **No reaction 1x**	**No detonation 2x** **Fire witnessed on video (I-tip)**
	**No experiment**	**Detonation1x**	**No reaction 2x** **1x(graze)**	**No experiment**

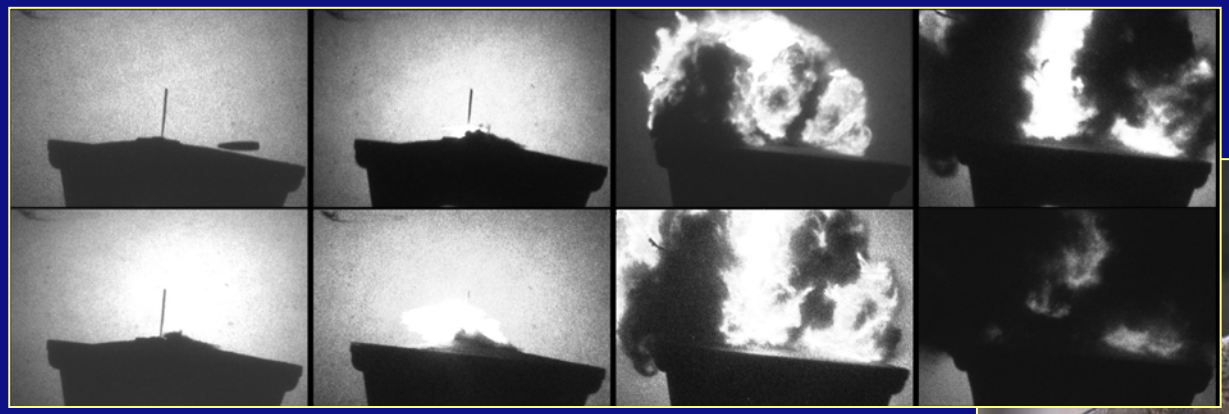
Conclusion from experiments

AP mine with detonator

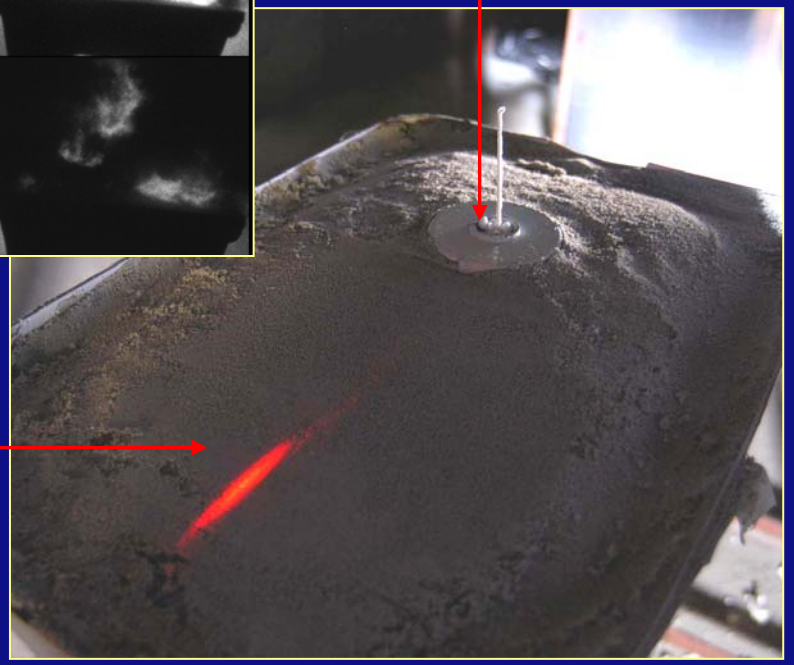
- only an armed AP-22C1 mine shows a chemical reaction (burning, deflagration or detonation) when it is impacted by a small calibre projectile.
- AP22 mine can only be detonated by an impact on the primary explosives
- These preliminary results show that mine neutralization with small caliber projectiles impact seems a promising technique

Latest results

- Experiments conducted on the mine without detonator with two other .50” projectiles
  - .50 PELE (mechanical break-up only)
  - .50 MP (4 out 4 deflagration)



AP mine buried in sand



Impact position

HIGH SPEED VIDEO